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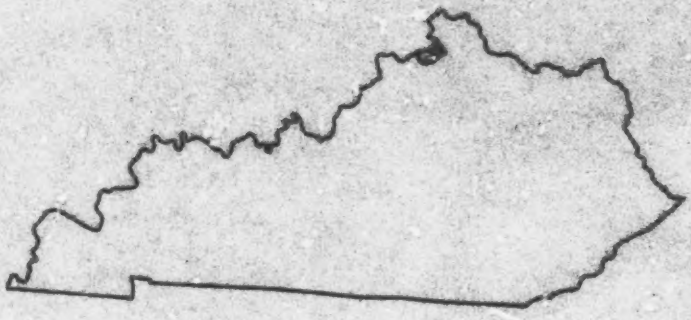
ORIGINAL

# FLOOD INSURANCE STUDY

## GALLATIN COUNTY, KENTUCKY

### UNINCORPORATED AREAS



AUGUST 19, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 210281

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## NOTICE TO
## FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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# FLOOD INSURANCE STUDY

## GALLATIN COUNTY, UNINCORPORATED AREAS, KENTUCKY

## 1.0 INTRODUCTION

### 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of Gallatin County, Kentucky, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared originally for purposes other than the National Flood Insurance Program. The data were identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. The Federal Emergency Management Agency (FEMA) performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the National Flood Insurance Program. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, FEMA, Atlanta, Georgia, for consideration for revision of this study.

### 1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were obtained from a U.S. Army Corps of Engineers (COE) report entitled, "Ohio River Profiles" (Reference 1).

### 1.3 Coordination

On September 20, 1986, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.



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## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Gallatin County, Kentucky. The area of study is shown on the Vicinity Map (Figure 1). The incorporated areas within the county were excluded from this study.

The areas studied by detailed methods were selected based on the extent and validity of available existing hydrologic and hydraulic data.

Flooding caused by overflow of the Ohio River was studied in detail within the county.

### 2.2 Community Description

Gallatin County is located on the south bank of the Ohio River in north-central Kentucky. It is situated approximately 30 miles southwest of the City of Cincinnati, Ohio, and approximately 55 miles north of the City of Louisville, Kentucky. Gallatin County is bordered on the north by Switzerland County, Indiana, on the east by Boone and Grant Counties, Kentucky, on the south by Owen County, Kentucky, and on the west by Carroll County, Kentucky. The 1980 population of Gallatin County was reported to be 4,842 (Reference 2), which represents a 15 percent increase from the 1970 population.

The climate of the area is typical of the Midwest, characterized by hot, humid summers with temperatures averaging 80 degrees Fahrenheit (°F) in July and cold winters with temperatures averaging 30 °F in January. The average annual rainfall is 40 inches (Reference 3).

### 2.3 Principal Flood Problems

Numerous areas along the Ohio River, including the Towns of Lamb, Vevay, Markland, Florence, and Patriot on the Indiana side of the river, are subject to flooding caused by the overflow of the Ohio River. The most noted of these floods were those of 1832, 1847, 1857, 1883, 1884, 1913, 1937, and 1964. The flood of 1937 is the worst on record and is considered to be greater than a 500-year frequency flood. No monetary estimates of flood damage in Gallatin County were available, but in Patriot, Indiana, 21 businesses and 94 homes were damaged by the floodwaters (Reference 3).

### 2.4 Flood Protection Measures

Due to the parameters of this existing data study, information regarding flood protection measures in the community is obtained only from the source report (Reference 1) and any other readily available sources. None of these sources provided information relating to the flood protection measures in the community.

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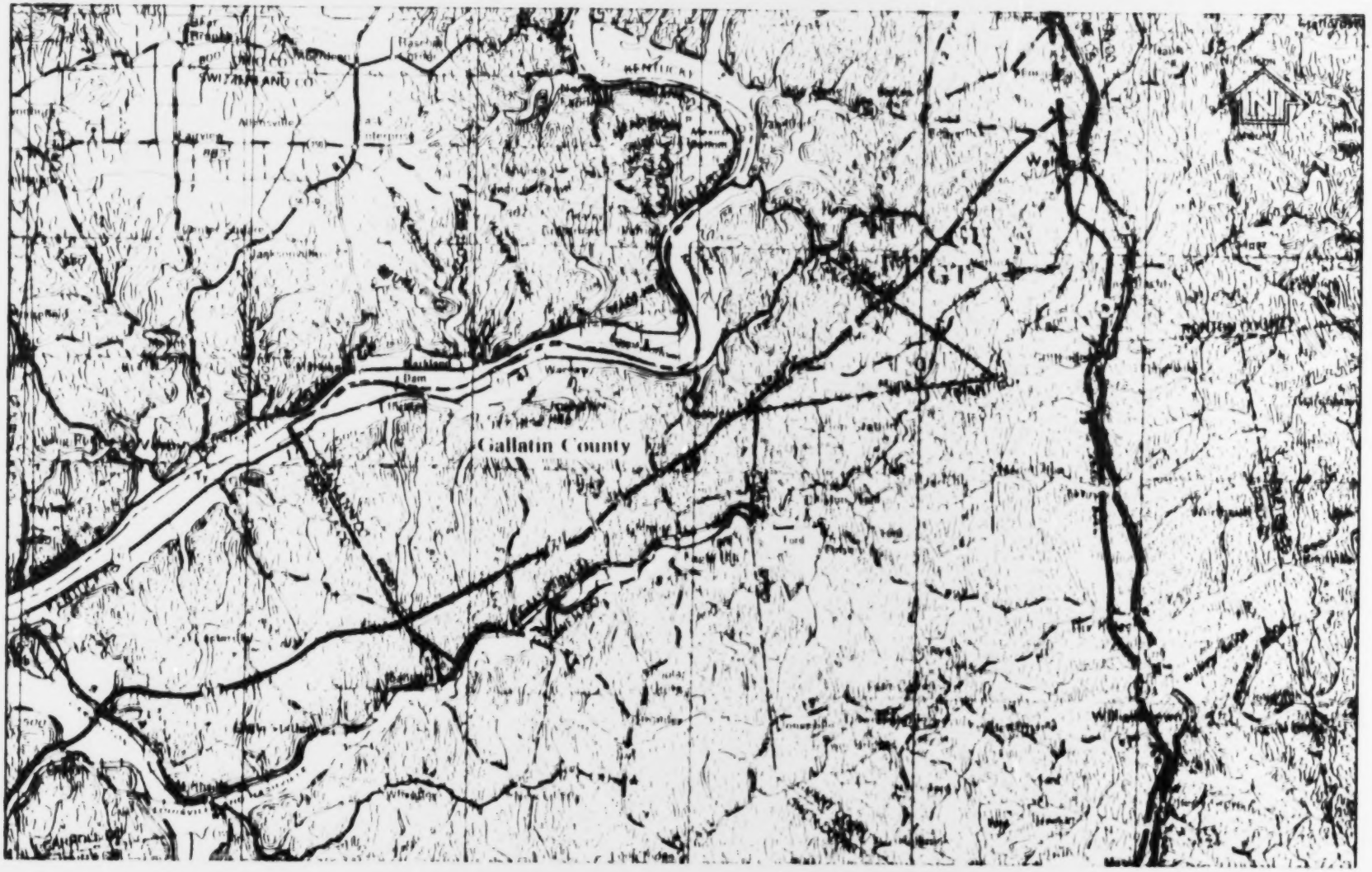


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

**GALLATIN COUNTY, KY**
**(UNINCORPORATED AREAS)**

APPROXIMATE SCALE

4 0 4 8 12 MILES

**VICINITY MAP**

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## 3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

### 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

The following information is principally taken from the "Ohio River Basin, Comprehensive Survey, Appendix C, Hydrology" (Reference 4).

Natural discharge-frequency relationships on the Ohio River were developed by the COE, Louisville District, in accordance with methods presented in "Statistical Methods in Hydrology" (Reference 5).

One method for determining the effect of impoundments of floodwaters is by reservoir holdout. The difference between a natural hydrograph and one resulting from the reservoir modification is routed downstream. This is done to determine the lowering of crest discharge due to storage effects using the standard methods explained in the COE engineering manual (Reference 6). This is generally simpler than routing the modified hydrograph, which must be combined with tributary inflow. To determine modified flood peaks on the Ohio River, 12 historical floods, plus 3 hypothetical ones of greater magnitude, were used in the analyses of flow modification. The flows of the 15 floods, considered representative of the basin, were modified by the operation of COE reservoirs, which were either completed or under construction.

The routing of floods and reservoir holdouts, modeled using a computer program by the COE, Ohio River Division, was used for this study.

Peak discharge-drainage area relationships for the 10-, 50-, and 100-year floods of each flooding source studied in detail in the community are shown in Table 1.

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TABLE 1 - SUMMARY OF DISCHARGES

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (SQ MILES) | PEAK DISCHARGE (CFS) 10-YEAR | 50-YEAR | 100-YEAR |
|---|---|---|---|---|
| OHIO RIVER at Markland Dam | 83,170 | 564,000 | 703,000 | 762,000 |

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

The 10-, 50-, and 100-year flood elevations were taken from the COE January 1981 water-surface profiles (Reference 1), which reflect the reductions of flow provided by reservoirs upstream of the study site.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations. Roughness values for the main channel of the Ohio River range from 0.029 to 0.031.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the NGVD.

## 4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual

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chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 7).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map.

### 4.2 Floodways

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. Floodways have not been shown since the source reports for this study did not provide information relating to floodways in the community.

## 5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

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## 6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

## 7.0 OTHER STUDIES

Flood Insurance Studies have been published for the Unincorporated Areas of Switzerland County, Indiana, and Boone County, Kentucky (References 3 and 8) and are in agreement with this study.

A Flood Insurance Study is also in progress for the City of Warsaw, Gallatin County, Kentucky (Reference 9) and is in agreement with this study.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Gallatin County (Reference 10).

## 8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 1371 Peachtree Street, NE., Suite 736, Atlanta, Georgia 30309.

## 9.0 REFERENCES AND BIBLIOGRAPHY


1. U.S. Army Corps of Engineers, Ohio River Division, Ohio River Profiles, Cincinnati, Ohio, January 1981.

2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Kentucky, Washington, D.C., February 1982.

3. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Switzerland County, Unincorporated Areas, Indiana, January 1980.

4. U.S. Army Corps of Engineers, Ohio River Basin, Comprehensive Survey, Appendix C, Hydrology, Cincinnati, Ohio, August 1966.

5. ————, Sacramento District, Office of the Chief, Statistical Methods in Hydrology, Leo R. Beard, July 1952 and January 1962.

6. ————, Engineering Manual, EM 1110-2-1408, March 1960.




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7. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Florence, Indiana-Kentucky, 1966; Patriot, Indiana-Kentucky, 1981; Vevay South, Kentucky-Indiana, 1967.

8. Federal Emergency Management Agency, Flood Insurance Study, Boone County, Unincorporated Areas, Kentucky, December 1980.

9. ————, Flood Insurance Study, City of Warsaw, Gallatin County, Kentucky, in progress.

10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Gallatin County, Unincorporated Areas, Kentucky, September 1976.

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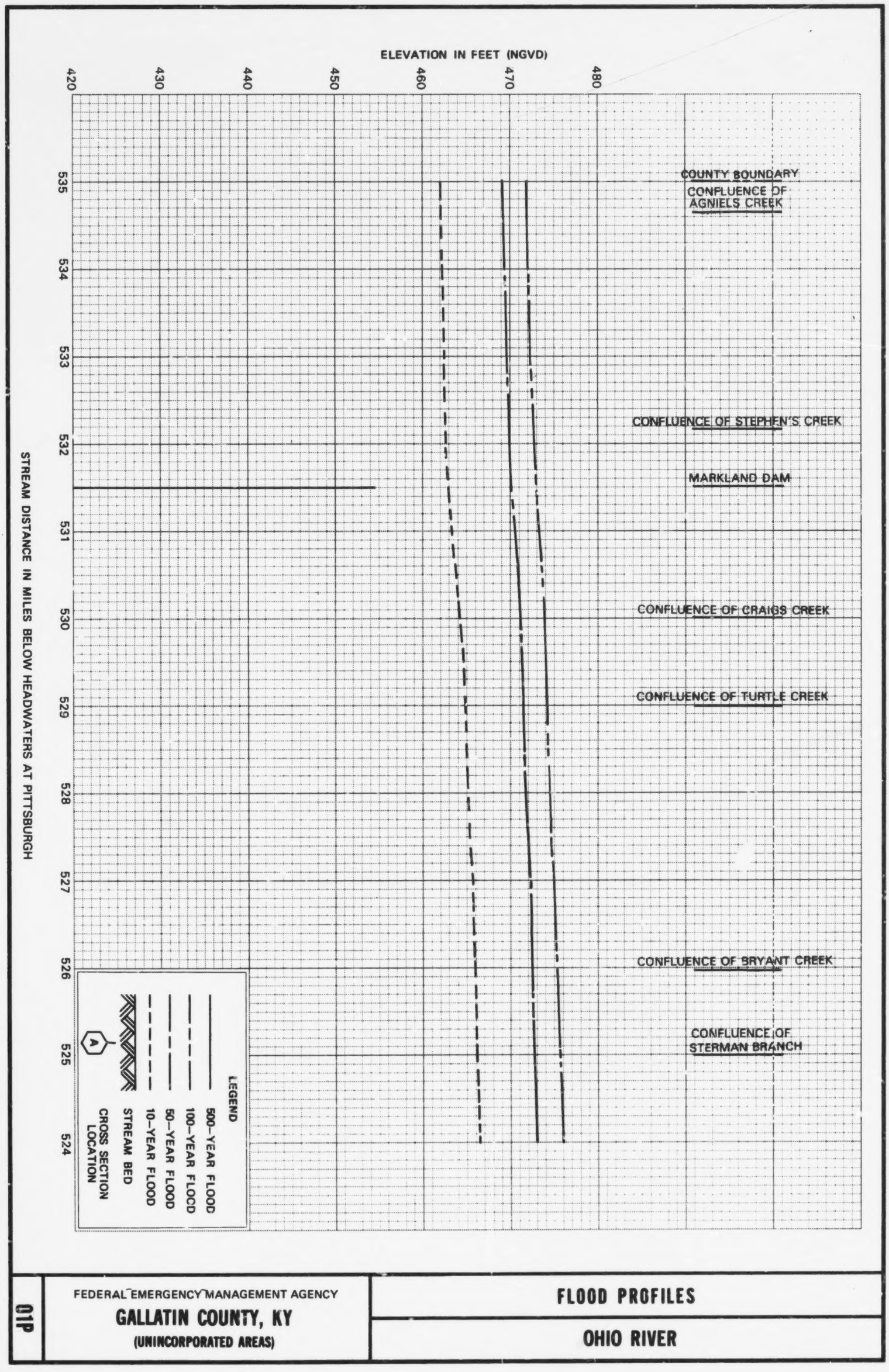


| | | |
|---|---|---|
| 01P | FEDERAL EMERGENCY MANAGEMENT AGENCY<br>**GALLATIN COUNTY, KY**<br>(UNINCORPORATED AREAS) | **FLOOD PROFILES**<br>**OHIO RIVER** |

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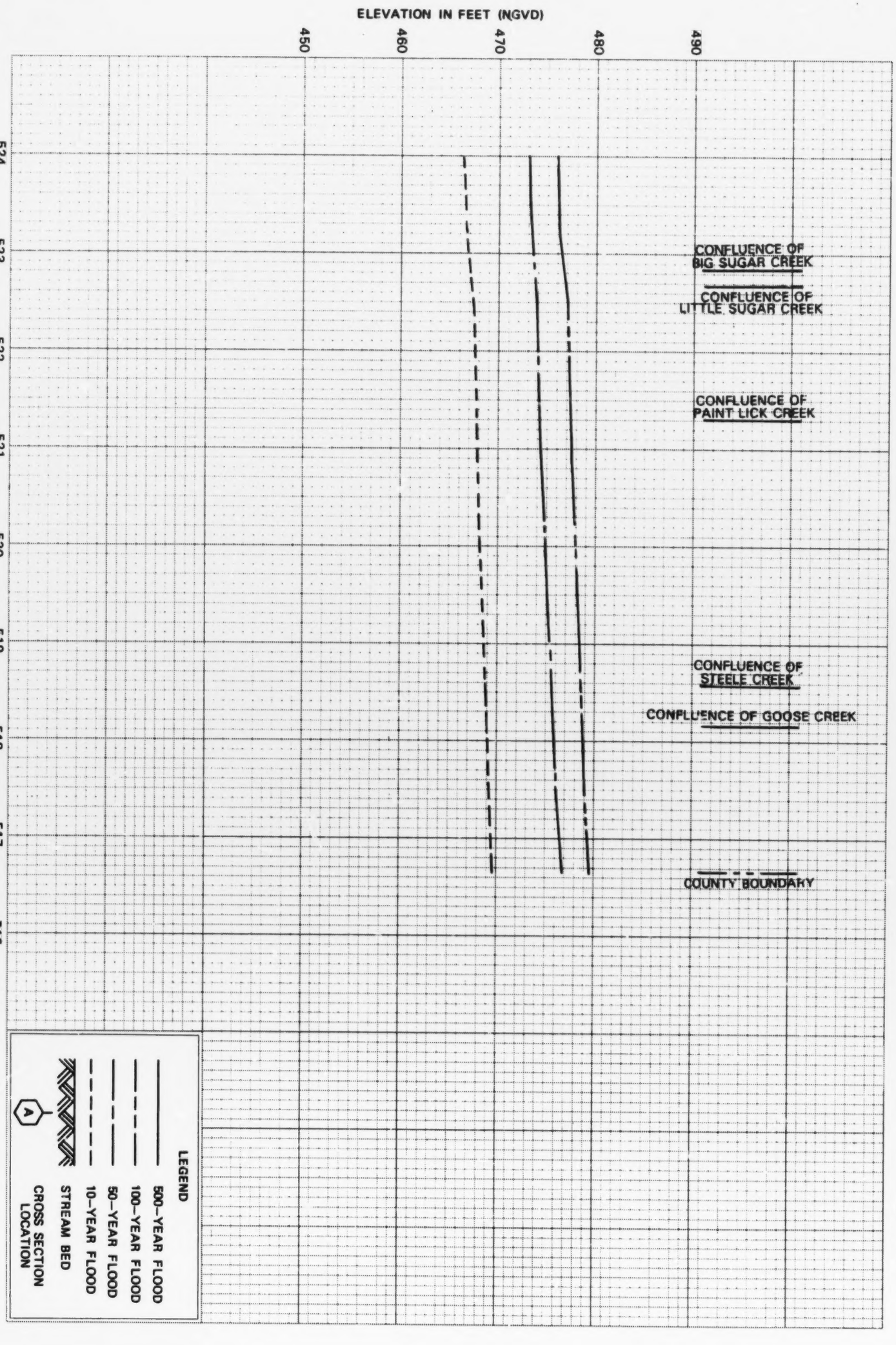


| | | |
|---|---|---|
| 02P | FEDERAL EMERGENCY MANAGEMENT AGENCY<br>**GALLATIN COUNTY, KY**<br>(UNINCORPORATED AREAS) | **FLOOD PROFILES**<br>**OHIO RIVER** |

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